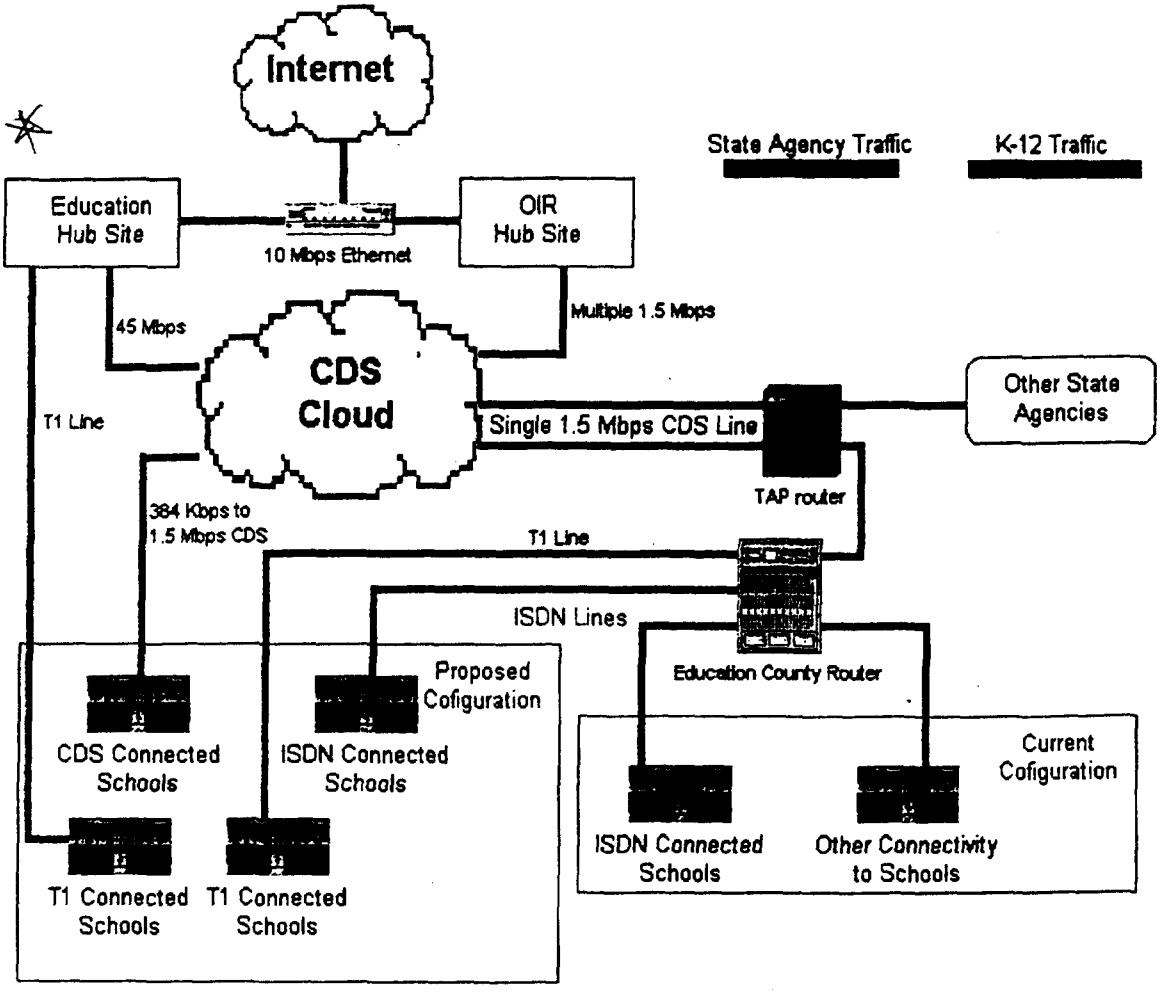
Priority and Target Performance	Technical Description	Rationale
Education hub sites **Components** • Establish scaleable bandwidth between 2Mbps and 45Mbps CDS egress point from ENA/TNII CDS cloud to Education Hub Sites. • Establish Caching Server at each EHS. • Establish Firewall at each EHS. • Install optional content filtering, if required by legislation. • Install mail server at each EHS. • Establish Peered Internet Connection to OIR's BellSouth.net circuits as required. • Redirect ECR traffic originating at TAPs through the TNII backbone to the EHS CDS egress points.	• The EHS will be co-located with OIR hub sites. • EHS caching server is Novell BorderWare Server running on Intel Platform. • EHS Firewall will be Checkpoint Firewall-1 running on SunSparc server. • CyberPatrol for servers will run on EHS Firewalls if content filtering is required. • Distributed mail server will be a scaleable platform capable of supporting regional mail accounts with web-based or POP3 interface. • 10 Mbps Ethernet line to BellSouth.net will be split through Ethernet switching hub. Peered routing will be established with ENA and BellSouth in addition to current routing with OIR. • TAP routers are programmed to forward ECR traffic to EHS CDS egress point.	• Education Hub Sites (EHS) allow K-12 traffic to be separated from other State backbone traffic, providing customer security, caching, and E-mail access. • EHS caching servers store an average of 74 percent of the common web pages used by schools. This dramatically improves web page response time and greatly reduces direct Internet connections for web pages. • EHS Firewalls provide all K-12 schools with statewide protection from common Internet hacking attacks. Optional content filtering on the Firewall can meet any state or federally legislated content filter mandates for the entire ConnecTEN network. • Current E-mail users are reliant upon shell-based E-mail access, which poses serious security, threats to E-mail servers. Web-based E-mail access will provide easy interface and transition away from shell accounts. • Peered Internet connection allows customization of Border Gateway Protocol (BGP) routing tables for K-12 sites. Custom BGP routing tables can correct the current non-contiguous IP addressing problem that is causing unnecessary city-to-city traversal of traffic. • Re-routing of ECR traffic via the TNII backbone will bring all K-12 traffic to the regional CDS egress point. This provides equal access to all EHS resources for either dedicated or ECR-connected school sites.

Priority and Target Performance	Technical Description	Rationale
DNS • Deploy K-12 DNS servers at Education hub sites under OIR DNS Authority. • ENA has contracted with NCR for engineers David Jones and Jeff Little, who will work with OIR to enhance DNS Services. • Meet or exceed current OIR DNS service levels. • Target DNS Service Levels: ◆ 80% of internal DNS names resolved within 1 second. ◆ 95% of internal DNS names resolved within 2 seconds. ◆ 100% of internal DNS names resolved within 10 seconds.	• Domain Name Service (DNS) is the IP Number "Telephone Book" for the Internet. • DNS servers are Unix Platforms scaled to meet service levels.	• DNS services are often distributed in large networks • All network services are dependent upon robust and consistent DNS. • DNS lookup is the first step in reaching a site on the Internet • Slow DNS response directly affects response time when accessing web sites on the Internet. • K-12 DNS servers are subordinate to OIR DNS authority and require agreed upon service levels.
Education County Router (ECR) Caching • Deploy EHS caching servers using Novell BorderWare at most ECRs. • Target hit percentage for web (port 80) traffic is 74%. • Access to caching server is obtained by pointing Netscape 2.02 or above browser to proxy at caching server. This is a simple change and can be implemented incrementally by teachers, TCs and administrative staff.	• ECR caching server is Intel Pentium Pro server with a minimum of 9GB storage. • School, ECR and EHS caching servers act as one hierarchical caching network with Novell BorderWare. • Once the Netscape browser is configured for proxy mode, automated browser updates can be utilized to enhance web service access. • Instructions for proxy entry in Netscape will be distributed via a web page. Proxy entry takes less than one minute per browser.	• Requests fulfilled by the caching server do not travel beyond the local county ECR, providing outstanding response time. • ECR caching servers remain in place if E-Rate funding is discontinued and will provide relief from bandwidth limitations. • BorderWare server on Intel platform is field-proven and competes with UNIX-based solutions in throughput tests. • PCs set for proxy mode do not require DNS to obtain web pages from a caching server. This improves response time by eliminating the DNS look-up step.

Priority and Target Performance	Technical Description	Rationale
Bandwidth Scalability • New scaleable routers are installed at all schools within the first 18 months of E-Rate funding. • Schools will be upgraded to scaleable, dedicated data service beginning with highest bandwidth needs first. • Schools are connected to CDS cloud as designated by network design and scalability criteria. • Schools are connected via dedicated T1 to ECR or EHS sites as designated by network design and scalability criteria. • Schools are upgraded to dual ISDN at ECR sites as designated by network design and scalability criteria.	• New routers support ISDN, CDS, Frame Relay, or ATM at speeds from 128Kbps to multiple 1.5 Mbps channels and can be moved to new services as network design rationale evolve. • CDS access is available in BellSouth territories and is scaleable from 128K to 1.5Mbps. • In non-Bell territories, dedicated T1 may be used for high bandwidth access. ECRs providing dedicated T1 access will have a caching server installed. • ISDN lines from schools upgraded to dedicated access will be moved to schools which require dual ISDN access.	• New scaleable routers utilize all current network access methods and extend life cycle. Simple software change can change network access protocols in routers. • Moving traffic from large schools away from ECRs will allow remaining ISDN users better throughput. This will alleviate the congestion that currently exists between the Educational County Router (ECR) and the TAP router. • Connecting schools directly to CDS cloud provides high-speed access to the Education hub sites without the need to increase county TAP/ECR bandwidth. • ECRs with dedicated T1 access require caching to reduce traffic on TNII backbone.
School Caching • Schools with greater than 1,200 students and 120 PCs will be given a caching server. • Access to caching server is obtained by pointing Netscape 2.02 or above browser to proxy at caching server. This is a simple change and can be implemented incrementally by teachers, TCs and administrative staff.	• School caching server is an Intel Pentium II server with 4GB of storage running Novell Fast Cache software. • School, ECR and EHS caching servers act as one hierarchical caching network with Novell BorderWare. • Once the Netscape browser is configured for proxy mode, automated browser updates can be utilized to enhance web service access. • Instructions for proxy entry in Netscape will be distributed via a web page. Proxy entry takes less than one minute per browser.	• Large schools cannot meet response time criteria with bandwidth upgrades alone. Caching brings responses to the school LAN level, providing immediate local response to web page request. • School caching enhances throughput for real-time web services and non-cached requests, such as video, audio or other real-time services.

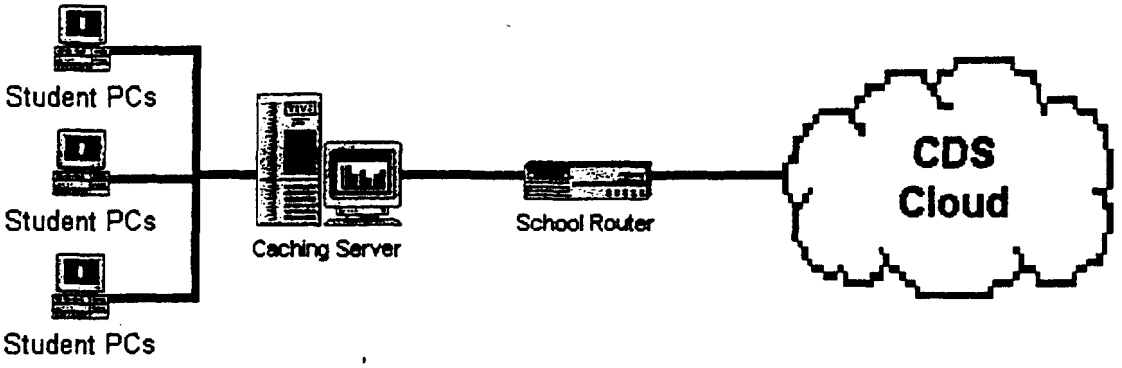
Priority and Target Performance	Technical Description	Rationale
Service Enhancements • Web-based client platform for E-mail access is made available to all E-mail users. • Shell account E-mail access is supplemented as users migrate to web based or POP3 E-mail client. • SDE administrative web servers are secured with a Firewall. • ENA works with SDE to further develop cohesive strategy for web-based administrative reporting.	• Distributed mail servers will be scaled to support 50,000 teachers and 5,000 administrators with current shell, web-based or POP3 interface. • Web-based software allows regular web browser to be utilized for E-mail retrieval. Web-based mail servers store mail for users, as do current shell accounts. • Web-based mail interface only requires name and password log-in, as do shell accounts.	• Current E-mail users are reliant upon shell-based E-mail access. This poses serious security threats to E-mail servers. Web-based E-mail access will provide easy interface and transition away from shell accounts. • Web-based administration servers will become operationally critical to SDE over time and must be treated as protected assets, as SDE would treat any core service.
Cabletron Replacement • ENA will replace Cabletron equipment at schools and ECRs with new scaleable routers.	• The current router market is set to change significantly in the next three months. ENA is certifying a variety of leading vendors' equipment (Bay Networks, Cisco, and Ascend see Appendix J) for use in the ConnecTEN network. This will allow ENA to select the optimum vendor at the time of deployment. • Proposed router platforms will be interoperable with the TNII backbone routers. • All platforms being certified fully support IPX and AppleTalk, Ethernet and Token Ring.	• Cabletron equipment is currently discontinued, superseded and not scaleable; support costs are increasing. • New school routers are scaleable from single ISDN to multiple T1 connections and have a substantial processor to handle future needs. The routers can utilize PPP, CDS, Frame Relay, ATM, and other popular wide area protocols. • Interface flexibility allows simple transition to adjust for E-Rate funding fluctuations.



State and K-12 Internet Traffic Flow

Scalability Chart for ConnecTEN			
Student Population	**Minimum PCs**	**Line Type**	**Enhancements**
Above 1,200	120	Full 1.5Mbps CDS	Caching Server
476 -1,199	48-120	Fractional CDS	
251 - 475	25 - 48	Dual ISDN w/High Compression	
<250	24	Single ISDN with High Compression	

This scalability chart reflects the estimated upgrades necessary to meet or exceed the proposed service level of two web pages per minute, based on population and PC count. Adjustments to scalability will be made based on meeting the service level criteria of two web pages per minute.



School Caching

Change Priority by Site

During the project design phase, a detailed per-school count of ConnecTEN PCs must be made in order to ensure a fair ordering of bandwidth upgrades. This will be conducted using a web-based polling method. Schools will not be upgraded *solely* based on student population. Schools must meet population *and PC count* criteria to qualify for their total bandwidth allocation.

Please see Appendix G for detailed spreadsheet concerning site-by-site changes by population, including equipment and bandwidth.

Glossary:

Caching - Caching is a method of storing web pages locally and providing them to users on demand. In a network using caching, the caching server is first queried to see if it has the requested page. If it does, the user gets the page from the caching server without going to the Internet. Caching servers improve response time and make web page access reliable.

Committed Information Rate (CIR) - This component is associated with Frame Relay service. CIR is the speed at which the Telephone Company guarantees throughput on the circuit. The bandwidth of the circuit does not determine the throughout. For example, if a customer has a 1.536 Mbps Frame Relay circuit with a "384" Kbps CIR, the telephone company only guarantees "384" Kbps of throughput. In the above example, any data transmissions greater than the "384" Kbps CIR level are not guaranteed by the telephone company.

Connectionless Data Service (CDS) - Fast packet digital data communication service that provides many-to-many connectivity for all locations on the network. CDS service also allows traffic to be transmitted up to the port speed without requiring additional cost components. CDS Service is highly reliable and is scaleable from 56Kbps up to 45 Mbps.

Data Link Connection Identifier (DLCI) - This component is associated with Frame Relay service. A DLCI is an address field that is used to specify a connection. When two DLCI's are mapped together, a Permanent Virtual Circuit (PVC) is created.

Domain Name Services (DNS) – A domain name is the English equivalent of an IP address. It allows users to identify resources on the Internet by a familiar name rather than a IP number. DNS servers act as translators for these names since computers only process IP addresses on the Internet.

Dynamic Host Control Protocol (DHCP) - DHCP is a method of automatically issuing IP addresses from a central server to individual computers. The alternative is *static* IP addressing which must be manually entered in each computer.

E.164 Address - This component is associated with CDS Service. A E.164 Address is the telephone number that is assigned to each CDS location. Each frame that is transmitted from the end-device terminal contains the E.164 address of the destination terminal and is transported through the network using a complex routing scheme.

Frame Relay Service - Fast packet digital data communication service that uses Permanent Virtual Circuits to establish a connection between two locations on the network. Frame Relay Service is highly reliable and is scaleable from 56Kbps up to 45 Mbps.

ISDN - Switched digital circuit that provides 2 - 64 Kbps "B or Bearer" channels that can be used for voice, data or video communications.

Permanent Virtual Circuit (PVC) - This component is associated with Frame Relay service. A PVC is the connection that is necessary to allow two Frame Relay sites to communicate with each other. Because a PVC is a logical connection, a single physical access link to a Frame Relay switch may contain multiple logical circuits. For example, Site A has a Frame Relay T-1 and wants to communicate with Sites B, C, D, and E. To accomplish this, Site A can set up a PVC to each of these sites over its single T-1 Frame Relay Link. Two Data Link Connection Identifiers are required for each PVC.

T-1 - A digital circuit that is designed to transmit information up to 1.544 Mbps. A T-1 contains twenty-four "64Kbps" channels that can be used to transport voice, data or video.

ATTACHMENT L

5.2.3.2

A personnel roster and resumes of key people who shall be assigned by the Proposer to perform duties or services under the contract. The roster should include estimated number of hours to be worked on the contract for each person, and the resumes shall detail each individual's title, education, current position with the Proposer, and employment history, training and experience in implementation and management of IP networks with comparable number of sites, using ISDN lines.

Hours over Term of Contract

Employee Name	# of Hours	Company
Al Ganier	2,000	ENA
Paul Van Hoesen	2,500	ENA
Eileen Amaba	2,000	ENA
Nathan Grochowski	1,000	ENA
Project Manager – Installation	2,700	ENA
Assistant Project Manager	2,700	ENA
Billing Manager	7,000	ENA
ENA School Partners Team (8)	56,000	ENA
Vickie Stanfill	800	BellSouth
David Patterson	1,500	BellSouth
Jack Honeycutt	2,000	BellSouth
Phil Evans	1,500	BellSouth
Duray Miller	3,000	BellSouth
Mark Cross	1,000	BellSouth
Randy Sullivan	750	BellSouth
Charlie Cox	1,500	BellSouth
Jerry Dunlap	1,500	ISDN-Net
Ken Russell	1,500	ISDN-Net
Keith Simmons	1,500	ISDN-Net
Timothy Stinson	7,000	ISDN-Net
Jim Pewitt	7,000	ISDN-Net
Tier II Engineer	3,000	ISDN-Net
Tier II Engineer	3,000	ISDN-Net
Elaine Williams	1,500	Lucent
Paul Bereaux	1,500	Lucent
Network Operating Manager	7,000	Lucent
Help Desk - Tier 1	7,000	Lucent
Help Desk - Tier 1	7,000	Lucent
Help Desk - Tier 1	7,000	Lucent
Help Desk - Tier 1	7,000	Lucent
Jeffrey Little	7,000	NCR
David Jones	7,000	NCR

Resumes can be found in Appendix E

These projected hours and personnel assignments are based on ENA's best estimates at this time. This information may be adjusted to meet actual service level requirements.

ATTACHMENT M

TENNESSEE REGULATORY AUTHORITY
DIRECTORS' CONFERENCE
Tuesday, February 3, 1998
VOLUME III

BEFORE: CHAIRMAN LYNN GREER
DIRECTOR SARA KYLE
DIRECTOR MELVIN MALONE

APPEARANCES: MR. DAVID WADDELL

COPY

Reported By:
Susan D. Delac

NASHVILLE COURT REPORTERS
P.O. Box 290903
Nashville, TN 37229-0903
(615) 885-5798

DIRECTOR KYLE: I vote yes.

DIRECTOR MALONE: Under Section 10c the question is, What funding mechanism should be adopted to fund Lifeline and Link-up?

And consistent with what we've done in this proceeding to date, I move that Lifeline and Link-up be funded from the Universal Service Fund.

DIRECTOR KYLE: Yes.

CHAIRMAN GREER: I agree. Issue 11, What support in addition to the federal support already adopted by the TRA should be provided to schools and libraries? I believe there are two subissues in that issue.

DIRECTOR MALONE: 11a states: The TRA should state specifically what discounts are available in Tennessee and at what levels.

Currently there are four services, school/parent communications service, in-classroom computer access service, ISDN, and distance learning video transport service that are provided to schools and libraries at discounted rates via tariff offerings.

On July 15, 1997, the TRA adopted the Federal Discount Matrix which specifically states the discount levels available to schools and libraries in

Tennessee. These discounts are applied to tariffed business rates in determining the applicable rates. For the most part, discounted rates provided to schools and libraries will be determined by the Federal Matrix. However, some services, the four mentioned above, are already provided discounts in accordance with the state approved plans. For these services, schools and libraries will have the opportunity to choose the state or federal discount, whichever is greater.

Additionally, because it is possible that federal funding could be depleted by the time some schools and libraries apply for federal discounts and because it is possible that some Tennessee schools may only minimally qualify for federal support, the continuance of state established education plans assure schools and libraries of receiving some level of discounted telephone service. In the interest of ensuring ubiquitous and affordable access to telecommunications services for schools and libraries in Tennessee, the TRA in this docket dated September 18, 1997 and captioned, Order Establishing Intrastate Discounts for Schools and Libraries Pursuant to Section 254(h) of the Telecommunications Act of 1996 and FCC Order 97-137 to allow Tennessee

schools and libraries to receive funding. Today, every school and library in Tennessee, as a result of the order entered September 18, 1997, can apply for its share of a national $625 million Universal Service Fund first and second quarter 1998, and a $2.25 billion fund each year thereafter.

Therefore, I move that we continue to require tariffed discounts for schools and libraries for school/parent communications service, in-classroom computer access service, ISDN, and distance learning video transport service.

CHAIRMAN GREER: I agree.

DIRECTOR KYLE: I'll agree.

DIRECTOR MALONE: 11b, How does the TRA address prediscount price complaints?

I move that the existing procedures for addressing prediscount price complaints should remain in effect and continue to be used.

CHAIRMAN GREER: I agree.

DIRECTOR KYLE: I'll agree.

CHAIRMAN GREER: Issue 12, What support should be provided to healthcare providers? And there are two subissues.

DIRECTOR MALONE: Subissue 12a, Should the TRA provide support in addition to that

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